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NOTICE.

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UNITED STATES.

PARASITIC HEMOPTYSES PRESENT IN THE UNITED STATES.

[Extract from proof sheets of report of Stiles and Hassall furnished by Dr. Stiles through the courtesy of Dr. Salmon, Chief of the Bureau of Animal Industry, United States Department of Agriculture.]

NOTE.—The attention of health officers and physicians is called to the important fact that the United States Bureau of Animal Industry has found over 50 cases of infection in hogs by a lung fluke known as *Paragonimus Westermanii.*

As stated by Dr. Stiles, 2 cases of the presence of this parasite in the United States were recorded in 1894 and 1895; once in a cat in Michigan, reported by Ward and Stiles; once in a dog in Ohio, reported by Kellicott and Ward. It was at that time hoped that, notwithstanding the fears expressed both by Stiles and by Ward, the infection would die out. Such, however, does not seem to have been the case, for the meat inspectors of the Bureau of Animal Industry, stationed at Cincinnati, have discovered, on repeated occasions, lung lesions which were new to them, and which Stiles and Hassall, zoologists of the Bureau, have determined as typical cases of the Asiatic parasitic hemoptysis originally described by Kerbert (1878) for the tiger, later by Manson (1880), and by Baelz (1880) for man; still later for the dog by Railliet (1890) and Tokishige (1892), and more recently for the cat.

Dr. Stiles has also stated that at the present moment he finds no justification for assuming that the American worm is specifically distinct from the form found in Asia, and that from a public health standpoint the Bureau of Animal Industry will be obliged to consider the worms collected from hogs in Cincinnati as specifically identical with the form found by Manson in man. He is of the opinion that the parasite has been introduced into this country, probably, by returning missionaries or by the Chinese or Japanese. He further believes that our troops, in returning from the East, will add to the infection already here by bringing sporadic cases of the disease with them.

An extensive account ([1]) of the malady, discussed from the standpoints of zoology, medicine, and public hygiene, will appear in the course of a few weeks.

From the proof sheets of this report, furnished by Dr. Stiles, the following data are extracted.

The characters of the parasite are as follows:

Genus PARAGONIMUS, Braun, 1899.

Species PARAGONIMUS WESTERMANII (Kerbert, 1878), Stiles and Hassall, 1900.

GENERIC DIAGNOSIS.—Fasciolidæ: Body medium large, thick, elongate, frequently oval, and on traverse section more or less round, usually somewhat attenuate toward posterior extremity. Cuticle provided with scale-like spines. Intestine with strong, somewhat elongate pharynx; very short œsophagus; intestinal cæca zigzag, extending to caudal end of the body. Median excretory stem (or bladder) large dorso-ventrally, irregular in outline, and extending cephalad to near the pharynx. Genital pore near caudal margin of ventral acetabulum, in median line or to the right or left. Copulatory organs (cirrus) absent. Testicles round (?) or branched, in posterior half of body, one each side of median line and one slightly posterior to the other. Ovary somewhat branched, the branches being thick and short, and the organ located postero-lateral of the ventral acetabulum, on the side (right or left) of the median line opposite to the main portion of the uterus. Receptaculum seminis absent; Laurer's canal present. Vitellaria enormously developed, extending from anterior to posterior end of the body and located (as seen in cross section) on the periphery, usually leaving a longitudinal free space both in the dorsal and ventral median field. The transverse vitello-ducts pass cephalad of the testicles, but caudad of ovary and uterus. Uterus may be only slightly developed or may form a comparatively large-sized rosette, more than half as broad as the body. It may be located entirely on one side (right or left) of median line or may extend both sides of median line, partially covering the ovary. Eggs rather large, about 80 to 118 *u* long by 48 to 60 *u* broad. Embryo develops after oviposition.

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[1] Stiles and Hassall, Notes on Parasites, 51. The lung fluke (*Paragonimus Westermanii*) in swine and its relation to parasitic hemoptysis in man. XVI. Annual Report, Bureau of Animal Industry, United States Department of Agriculture, pp. 560–611, figs. 24–28, and Plates XXIII, XXIV, figs. 1–4.

HABITAT.—Encysted, usually two in each capsule, in lungs of mammals.

TYPE SPECIES.—*Paragonimus Westermanii* (Kerbert, 1878).

SPECIFIC DIAGNOSIS.—*Paragonimus:* 8 to 16 mm. (after Kellicott 15 to 20 mm.) long, 4 to 8 mm. broad, 2 to 5 mm. thick; plump, pinkish to reddish brown (alive) or slate (preserved) in color; live specimens are depressed and with variable outline; preserved specimens often oval to elongate pyriform, transverse section round or nearly so, anterior end bluntly rounded, posterior end less blunt. Oral sucker 0.53 to nearly 0.75 mm. (Leuckart) or more (0.864 by 1.017 mm. or 1 to 1.4 mm.[1] (Ward); or 0.80 to 1.12 by 0.80 to 0.83 mm. (Stiles & Hassall) 0.78; (Kerbert) in diameter, terminal or subterminal in different specimens from the same lung. Ventral acetabulum (0.6 to at most 0.75 mm.—Leuckart; 0.78 mm.—Kerbert; 0.75 to 1.017 mm.—Ward; 0.88 to 1.2 by 0.86 to 1.44 mm.—Stiles & Hassall) very slightly larger than oral sucker; situated somewhat anterior to middle of the body, 2 to 4 mm. back of oral sucker. Cuticle provided with broad scale-like spines.[2] Genital pore, often indistinct, close to the caudal margin of ventral acetabulum, may be in the median line or immediately to the right or left of it.[3] Pharynx elongate; œsophagus very short, so that the bifurcation of the intestine is considerably anterior to the ventral acetabulum; intestinal cæca usually somewhat zigzag, some distance from each other, run irregularly to posterior extremity. *Male organs:* Cirrus and cirrus pouch absent; ductus ejaculatorius straight; testicles tubular, ramified, one slightly posterior to other, on each side of median line. *Female organs:* Ovary branched, lateral, right or left of median line, somewhat posterior to acetabulum and antero-ventral of transverse vitelloduct; on the opposite side of median line, at about the same height, is situated a lobate shell-gland and a rather short, massed uterus; in some specimens the latter may spread across the median line and partially cover the ovary; folds of uterus extend ventrally of shell-gland; vitellogene glands marginal, highly developed, extending from anterior to posterior extremity, often leaving but a small portion of the dorsal and ventral median field uncovered; transverse vitello-ducts dorsal; vitelline reservoir large; Laurer's canal present. Eggs oval, 80 to 100 *u* long by 56 *u* broad (Leuckart); 96 to 118 *u* long by 48 to 53 *u* broad (Ward); 68 to 96 *u* long by 48 to 60 *u* broad (S. & H.); yellow shell. Miracidium ciliated, develops after eggs leave the host. Sporocyst, redia, cercaria, and intermediate host not known.

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[1] Suckers distorted, measurements not exact.—Ward.

[2] Largest in middle of the body, after Leuckart, but largest on anterior portion, after Kerbert; smallest around mouth, after Stiles & Hassall.

[3] The character attributed to this species relative to the situation of the genital pore on the left of the lateral line would appear to be somewhat diagrammatic; we have found it median, right or left, in specimens from hogs, and Kerbert reports it median.

Table of hosts.

Host.	Locality.	Collector.	Authority.
Royal tiger (*felis tigris*)	Amsterdam, Holland	Westerman	Kerbert, 1878.
Do	Hamburg, Germany	Bolau	Kerbert, 1881.
Do			Weber, 1891.
Cat (*felis domestica*) (*a*)	Ann Arbor, Mich	Ward	Ward, 1894.
Dog (*canis familiaris*)	Japan	[At Paris Exposition.]?	Railliet, 1890.
Do	Columbus, Ohio, U. S. A	Kellicott	Ward, 1895.
Hog (*sus scrofula domestica*) (*b*)	Cincinnati, Ohio, U. S. A	Payne	Stiles & Hassall.
Man (*homo sapiens*)	Formosa, China	Ringer	Cobbold, 1880.
Do	Japan	Baelz	Manson, 1881.
Do	Korea	do	Baelz, 1883.

a See, also, geographical distribution of the disease.
b See, also, medical discussion.

LIFE HISTORY.—The complete life cycle of the lung fluke has not yet been experimentally demonstrated. According to our present knowledge, the egg does not develop until it leaves the host in the sputum.

Miracidium (*ciliated embryo*).—Thus far at least two observers (Manson, 1882, and Nakahama, 1883) have succeeded in raising the embryonic stage. Manson (1882) states that when the eggs are washed free from the sputum and kept in water at a temperature of 80° to 94° F. (26.7° to 34.4° C.) an embryo develops in about six weeks to two months. Nakahama succeeded in showing that when the eggs which are expectorated in the sputum are subjected to a temperature of 30° C. (86° F.) for twenty-eight days the ciliated embryo is developed.

How long the eggs preserve their vitality in dried sputum or in dust does not appear to have been established. From a hygienic standpoint definite information on this point is important. Remaining in moist sputum for any length of time, corresponding to a part of Manson's experiments, would probably rarely occur in nature.

Beyond the miracidium stage nothing is positively demonstrated in the development of *paragonimus westermanii.* As Leuckart remarks, it would be contrary to all analogy to assume that this is the infecting stage for man and other animals. On the contrary, the presence of cilia indicates an acquatic life, and, so far as can be foreseen from analogy, the miracidium, after swimming around in water, will eventually attack some invertebrate (probably a mollusk) and will develop into a sporocyst; rediæ and cercariæ will probably be formed, much the same as are described for *fasciola hepatica,* and either an encysted or free-swimming cercaria will in all probability be the stage in which the parasite will enter its final host (man, cat, tiger, dog, hog).

Whether it will immediately attack the lungs, as suggested by Baelz, or first some other organ and later wander to the lungs, as suggested by Leuckart (1889), is an open question. In this connection reference may be made to the finding of an agamic distome in hogs' muscles by Mr. Bullard at Buffalo, N. Y. It can not at present be considered impossible that Bullard's parasites represent a younger stage of the lung fluke, either accidentally or normally encysted in the muscular tissue.

SOURCE OF INFECTION.—The discussion of the life history and the assumption that a cercaria forms the infecting stage bring up several views expressed in Japan. Throughout the Asiatic literature on the subject frequent references are made to the water supply, and it is clear that our Eastern colleagues look upon this as the source of infection. This view has much in its favor, and cautious persons will do well to drink only boiled or filtered water, especially when in infected fluke areas. The followlng references by various writers will be of interest in this connection. Manson (1882) in referring to one of his patients (Heng) writes:

> He says he never exercised discretion about the water he drank, especially when young; used to take it from the river, well, paddy field, or ditch—whichever lay most convenient; and he says that nearly all North Formosans are similarly indiscreet.

As prophylactic measures, Kiyono, Suga, and Yamagata (1881) advise against eating "raw eggs, uncooked fish, mussels, etc." Dr. Inoui and Yamagiwa (1890) state that in Okayama, where they studied a number of cases, a species of snail belonging to the genus *Limnœus* and known as "Nina," is very abundant. Although they examined large numbers of these mollusks, they did not find any cercariæ, rediæ, or embryos of the lung fluke. Similar negative results attended their dissection of small fish. The peasants eat both snails and fish, but usually cooked. The inhabitants of the villages say that chickens suffer from a cough similar to that noticed in this malady, and that they eat the sputa of persons suffering from lung fluke disease. On this account Inoui and Yamagiwa examined both chickens and eggs anatomically and microscopically, but without finding any trace of infection. As a prophylactic measure, Yamagiwa, in a later article (1892), also advises against eating raw meat.

That chickens eat human sputa is a well-known fact, but the possibility of their becoming infected with lung flukes through sputum from lung fluke patients may safely be looked upon as excluded. It seems possible that the cough referred to may be connected with the chicken disease known as "gapes," caused by *Syngamus trachealis* in the windpipe; while it seems more than probable that hens' eggs have fallen under suspicion because of the occasional presence of a fluke, which, to the casual observer, is not entirely unlike the lung fluke; it belongs to the species *Prosthogonimus ovatus* and has nothing to do with *Paragonimus Westermanii.* As for not eating raw meat, the advice is good on general principles, but it does not at present appear that such food will come into consideration as a probable source of infection. That Bullard's agamic distome in the muscles of hogs is the infecting stage of *P. Westermanii* may be admitted as among the remote possibilities, but hardly more. Very little pork is eaten in northern Japan, and, while eaten more in southern Japan, it is not a common article of diet among the poorer classes. This fact, and also the fact that the parasite is so much more common in men than in women, rather detract still more from the probability of such a source of infection. (See also Abattoir inspection.) Should the unexpected prove to be the case, and Bullard's encysted form actually represent the long looked for stage of *P. Westermanii*, ordinary curing or cooking will undoubtedly prevent all danger of infection. Of all possible sources of infection thus far suggested, the water supply and the mollusks would appear to be more natural carriers of the cercarian stage than anything else. The lion, cat, dog, hog, and man—all of the animals for which this lung fluke[1] has been reported—are in the habit of eating meat, but all of them also drink water.

THE LUNG FLUKE IN MAN AS CAUSE OF PARASITIC HEMOPTYSIS AND JACKSONIAN (CORTICAL) EPILEPSY.

NAME OF THE DISEASE.—The disease now under discussion is known under the following names:

ENGLISH.—*Parasitical hæmoptysis* Manson, 1880, and The Lancet, 1880, *Endemic hæmoptysis* Manson, 1883; *Lung fluke disease* (as vernacular term); Pulmonary distomatosis (in part).

GERMAN.—*Parasitäre Hæmoptoë* Baelz, 1880; *Gregarinose pulmonum* Baelz, 1880; *Wurm Hæmoptoe* Leuckart, 1889; *Lungendistomen-Krankheit* Yamagiwa, 1892; *Distomatose pulmonum.*

FRENCH.—*Hémoptysie parasitaire* Chédan, 1886; *Distomatose pulmonaire* Blanchard, 1895.

ITALIAN.—*Emottisi parassitica* Sonsino, 1884; *Emottisi cronica* Sonsino, 1896.

SPANISH.—*Hemoptisis parasitaria* Bonis & Cortezo, 1882.

LATIN.—*Gregarinosis pulmonis* Bonis & Cortezo, 1882.

The presence of lung flukes in man causes various symptoms, according to the location of the parasites. The two chief clinical forms in which the malady appears are the so-called parasitic hemoptysis and parasitic hemoptysis in connection with Jacksonian (cortical) epilepsy.

GEOGRAPHICAL DISTRIBUTION OF THE DISEASE.—Lung fluke disease has been reported for the following places:

Japan.—Hon-Shu Island, from northeast (provinces of Awomori, Sendai, Izu, Shinano, and Gifu) to southwest (provinces of Okayama, Shimane, and Yamaguchi); also on the Kiushu Islands (provinces of Kumamoto, Nagasaki, and Kagoshima). (See Yamagiwa, 1892, p. 453.)

China.—North Formosa, especially, and Manson believes the large number of cases of hemoptysis he formerly noticed in central and southern Formosa, are of the same nature. (See Manson, 1882.)

Korea.—Case of a Korean royal prince. (See Baelz, 1883.)

The Philippines.—It probably occurs in the Philippines, but this is not yet demonstrated.

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[1] *Herpestes*, the host of *Paragonimus compactus*, and *Lutra*, the host of *P. rudis*, are also carnivorous.